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Research Article

The influence of self-efficacy, learning attitude, and learning independence on students' metacognitive awareness and skills

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This study analyzes the influence of self-efficacy, learning attitude, and learning independence on students' metacognitive awareness and skills. The research employs a non-experimental quantitative design through a cross-sectional survey involving 340 Indonesian high school students. The findings, based on Structural Equation Modeling analysis, reveal that learning attitude influences metacognitive awareness but not metacognitive skills. Learning independence has a significant direct effect on both metacognitive awareness and skills, with metacognitive awareness serving as a key mediator linking these factors to metacognitive skills. Conversely, self-efficacy does not show a significant effect on either metacognitive awareness or skills. The study also indicates no significant differences in the influence between latent variables based on gender. These findings underscore the critical role of learning attitude and learning independence in enhancing metacognitive abilities. The results provide practical implications for educators and policymakers to design strategies that support reflective and independent learning, thereby fostering the development of higher-order thinking skills essential for academic success and lifelong learning.

Keywords: Self-efficacy; Learning attitude; Learning independence; Metacognitive awareness and skills

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1. Introduction

Metacognition is the main factor in improving academic success and lifelong learning abilities. Along with the education paradigm changing which focuses on independent learning and higher-order thinking skills, students' metacognitive awareness and skill are significantly organized. Metacognitive awareness and skills enable student to effectively evaluate, plan, and organize their learning activities, which increase academic performance and solves personal life challenges (Amin et al., 2020; Vellanki et al., 2024). Numerous studies highlight the neccesity of more throughly developing pupil's metacognotive skills (Antika et al., 2022; Kallio et al., 2018; Negi, 2024). This can result in effective learning processes and outcomes that enhance student's personal development (Hindun et al., 2020; Ramadhanti & Yanda, 2021).

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Self-efficacy, learning attitude, and learning independence have been recognized as key factors in shaping students' metacognitive development. Self-eficiacy, or the belief in one's capability to sucessfuly accomplish specific task, has been consistently associated with metacognitive behaviours such as setting goal and self-monitoring (Di et al., 2022; Durak et al., 2019; Tian et al., 2018). Similary, a positive learning a positive learning attitude has been found to boost cognitive engangement and promote the use of metacognitive strategies (Santyasa et al., 2022; Tshering, 2024). Moreover, leraning independence, which refers to a student's abitlity to manage their own learning process, has been recognized as a prequisite for the growth of self-reguilation and reflective practices (Regmi & Jones, 2020). These factors collectivelly influence student's metacognitive awarness and skills, highlightihing the importance of understanding their interconnectedness.

Several researchers have scrutinized the relationship between self-eficiacy and metacognitive processes, these suggest that individuals with strong self-eficiacy are more inclined to pratice self-reflection and implementadaptive learning strategies. Studies by Chen et al. (2020) and Di et al. (2022) indicate that students with belief in their abilities demonstrates higher presevarance and enhance self-regulation skills, both of which are crucial aspects of metacognition. These positive results are related to studies on learning attitudes, which presents attitude has a considerable impact on student's cognitive and emotional engangement (Lam, 2024; Ramzan et al., 2023; Wang, 2022). A positive learning attitude increases student's motivation to use metacognitive strategies. Therefore, it enhances their ability to monitor and control their cognitive processes.

Learning independence is also a key factor because its role influence on shaping metacognitive skills. Based on self-determination theory proposed by Qosim (2023) and Hindun et al. (2020) autonomous are better at setting learning goals, evaluating their progress, and making strategic adjustments, all of which foster metacognitive awareness. Studies by Siqueira et al. (2020) support the idea that learning independence can improve student's capacity for self-regulation and reflective thinking. These studies emphasize the significant role of self-efficiacy, learning attitudes, and learning independence as factors that can impact the development of students' metacognitive.

Although previous research has explained the individual effects of self-efficacy, learning attitudes, and learning independence on metacognitive awareness and skills, the attention given to their combined influence is still limited. Existing research tends to use a separate approach, studying each factor individually without considering their interactions. Although the studies established a basic relationship between self-efficacy and self-regulation, they did not discuss how this relationship could be moderated or strengthened by attitudes or learning independence (Kim, 2023; Yulian, 2024). A similar finding was also observed in research on learning attitudes and learning independence, which mostly focused on their direct effects without exploring the synergistic interactions between these variables.

This research aims to analyze the influence of self-efficacy, learning attitudes, and learning independence on students' metacognitive awareness and skills. This research explores the individual and combined effects of these factors to identify their relative contributions and interactions. Additionally, special attention to the gender factor also becomes a focal point in this research. The novelty of this research lies in the integrative approach used, which aims to bridge the gap in the literature by exploring the synergistic relationships between these variables. This research is expected to provide applicable insights for educators and policymakers to develop more targeted interventions in enhancing students' metacognitive abilities.

2. Conceptual Framework and Hypothesis Development

Self-efficacy is an individual's belief in their ability to successfully complete a specific task (Milam et al., 2019). This belief can enhance metacognitive awareness because individuals who have confidence in their abilities tend to be more reflective about the learning process (Corbí et al., 2024). Such individuals are generally more conscious of the strategies they use, aware of potential

mistakes, and mindful of their achievements (Fan et al., 2024). Therefore, it is expected that higher levels of self-efficacy are associated with greater metacognitive awareness.

H1: Self-efficacy has a positive influence on students' metacognitive awareness.

Self-efficacy is closely linked to metacognitive skills because individuals with high self-efficacy tend to apply learning strategies actively and effectively (Yokoyama, 2019). Such students are more capable of independently planning, monitoring, and evaluating their learning processes (Supervía et al., 2022). As a result, it is proposed that self-efficacy positively influences the development of metacognitive skills.

H2: Self-efficacy has a positive influence on students' metacognitive skills.

A positive learning attitude—characterized by interest, motivation, and a sense of responsibility—encourages students to be more attentive to their thinking processes (Alkursheh, 2024; Xiao-yan, 2024). When students have constructive learning attitudes, they tend to be more open to understanding their cognitive processes and more aware of the strategies they apply (Karataş & Arpacı, 2021). Therefore, a good learning attitude is expected to promote higher metacognitive awareness.

H3: Learning attitudes have a positive influence on students' metacognitive awareness.

A positive learning attitude encourages the consistent use of metacognitive strategies (Granjeiro, 2019; Listiana et al., 2016). Students who demonstrate enthusiasm and proactivity in learning are more likely to engage in planning, monitoring, and self-evaluation (Sunway et al., 2024). Consequently, learning attitudes play a significant role in the development of metacognitive skills.

H4: Learning attitudes have a positive influence on students' metacognitive skills.

Learning independence refers to students' ability to manage and direct their own learning (Qosim, 2023). Independent learners are typically more attuned to their cognitive processes and tend to reflect on their learning experiences (Cristea et al., 2023). Since independent learners are accustomed to making their own learning decisions, they are likely to have greater metacognitive awareness (Stambuk-Castellano et al., 2024).

H5: Learning independence has a positive influence on students' metacognitive awareness.

Independent learning requires core metacognitive skills such as planning, monitoring, and evaluating (Vellanki et al., 2024). Students who learn independently are generally used to setting goals, devising strategies, and assessing their progress actively (Ekasari & Ahmad, 2023; Maisyaroh et al., 2024). Therefore, learning independence is expected to positively impact the development of students' metacognitive skills.

H6: Learning independence has a positive influence on students' metacognitive skills.

Metacognitive awareness forms the foundation of metacognitive skills (Al-Khresheh & Al Basheer Ben Ali, 2023; Pratama, 2018). Being aware of one's thinking processes helps students select appropriate learning strategies, identify weaknesses, and adjust their approaches accordingly (Masoodi, 2018; Qin et al., 2022). Therefore, metacognitive awareness is expected to have a direct and significant effect on the development of metacognitive skills.

H7: Metacognitive awareness has a positive influence on students' metacognitive skills.

High self-efficacy fosters students' awareness and understanding of their learning processes (Salari & Farahian, 2022; Tian et al., 2018). This awareness, in turn, helps transform confidence into more effective learning skills. Metacognitive awareness thus mediates the relationship between self-efficacy and metacognitive skills (Yelgeç & Dağyar, 2022).

H8: Metacognitive awareness mediates the positive relationship between self-efficacy and students' metacognitive skills.

A positive learning attitude helps students become more aware of their cognitive processes, which lays the groundwork for developing metacognitive strategies (Hindun et al., 2020). In this

way, metacognitive awareness mediates the relationship between learning attitudes and metacognitive skills.

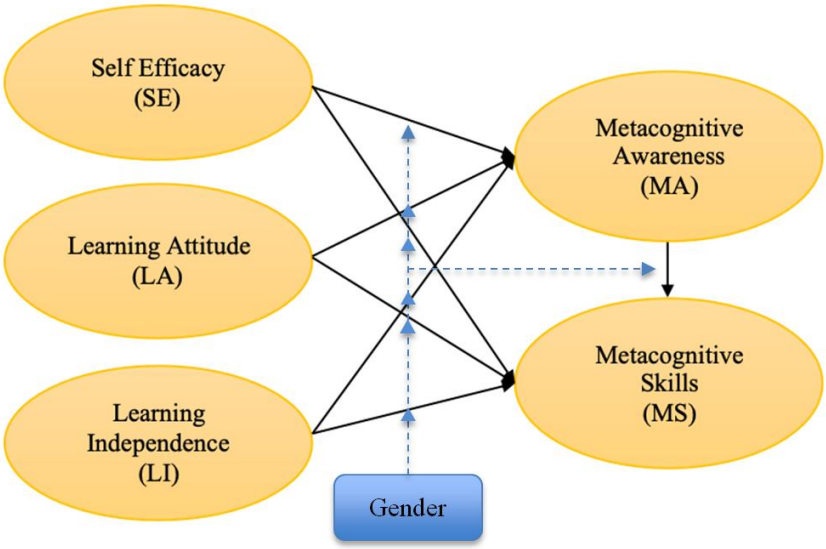
H9: Metacognitive awareness mediates the positive relationship between learning attitudes and students' metacognitive skills.

Students with high learning independence tend to be more conscious of their learning processes and take greater responsibility for their progress. This encourages them to develop metacognitive skills actively (Khodaei et al., 2022; Teng et al., 2021; Wardoyo et al., 2021). Here, metacognitive awareness acts as a mediator, strengthening the relationship between learning independence and metacognitive skills.

H10: Metacognitive awareness mediates the positive relationship between learning independence and students' metacognitive skills.

The SEM model diagram showing the research hypothesis is presented in Figure 1.

Figure 1
SEM Model Diagram



3. Method

3.1. Research Design

This research uses a non-experimental quantitative design with a cross-sectional survey (Mahande et al., 2025). Cross-sectional is conducted with the aim of collecting data from a specific population at one time. The Structural Equation Modeling [SEM] approach is capable of analyzing the complex relationships between self-efficacy, learning attitudes, and learning independence variables and metacognitive awareness and skills variables simultaneously, while also allowing for the simultaneous testing of measurement and structural models.

3.2. Participants

Participants are all students of Muhammadiyah Senior High School [SMA] in Surabaya City, Indonesia. The research sample must come from the science classes and fill out the online instrument voluntarily without coercion. Thus, out of 2510 students from 7 schools and three different cohorts (grades X, XI, and XII), only 340 qualified and collected data. Furthermore, gender as a moderating variable has significant utility in identifying differences in the influence of independent variables on the dependent variable between male and female groups. Evaluating the interaction between gender and other variables, researchers can understand how student characteristics or learning responses may differ based on gender. The selection of the research sample also considers the analysis of partial least square structural equation modeling [PLS-SEM], with the number of samples chosen being five to ten times the number of existing indicators (Hair

et al., 2019). The students who participated in this study have agreed to take part in the research and fill out the instruments used during the study. The demographics of the research participants are presented in Table 1.

Table 1
Distribution of participants based on demographics

Gender Variable	*Amount*	*Percentage (%)*
Male	153	45
Female	187	55

3.3. Instruments and Data Collection for Research

The instrument in the form of an online questionnaire was developed based on a review of relevant literature (see Appendix 1) and has passed the expert validation stage. All instrument questions were formulated using a four-point Likert scale (4 = strongly agree, 3 = agree, 2 = disagree, 1 = strongly disagree). The questionnaire was validated by 3 expert lecturers to obtain feedback and improvement suggestions in order to produce accurate and reliable data. Before the instrument is used in the field, the questionnaire was pilot-tested on a limited basis with 20 students to identify any statements that could lead to misinterpretation. Instruments that no longer show any anomalies are ready to be used for a full-scale survey with students. Data collection was conducted during the learning process at SMA Muhammadiyah in the city of Surabaya in January 2025.

3.4. Data Analysis Techniques

Data analysis using SEM software SmartPLS 3. The validity of the measurement model is assessed through construct validity (convergent and discriminant) (Hair et al., 2021).The structural model is assessed through path coefficients and hypothesis testing. The evaluation of the reflective measurement model for validity assessment is evaluated through outer loading (> 0.70) (Hair et al., 2019). Meanwhile, for reliability consistency, it is evaluated through Cronbach's alpha (> .70), rho A (> .70), and Composite Reliability [CR] (> .70) (Mahande et al., 2025; Syamsiah et al., 2024). The benchmark value for internal consistency ranges from 0 to 1. The higher the internal consistency value, the higher the level of reliability. Convergent validity is measured through average variance extracted [AVE] (> 0.50). Discriminant validity is assessed through the Fornell-Larcker criterion at the construct level and cross-loading analysis at the indicator level (Barclay & Thomson, 1995). According to the Fornell-Larcker criterion, the square root of AVE (in the diagonal) for each variable must be greater than the correlation with other variables (Fornell & Larcker, 1981; Henseler et al., 2015). In addition, the cross-loading value must have the highest value among all other cross-loading values (Hair et al., 2019).

The T and F bootstrapping statistical tests were conducted to determine the path coefficient levels using a structural model ($t > 1.96$, and $p < .05$) at a 95% confidence interval with 5,000 subsamples (Henseler, 2012). To test the hypothesis on the gender variable, Multi-Group Analysis (MGA) PLS was used. In addition, the categories of the coefficient of determination (R2) are also measured with weak (0.25), moderate (0.50), and strong (0.75) categories (Hair et al., 2021).

3.5. Ethical Procedures

The study was conducted in accordance with ethical research principles, including informed consent from all participants who were explained the purpose, procedures, and their rights in the study. Data collected were kept confidential and anonymized to prevent individual identification. Participation was voluntary and participants had the right to withdraw at any time without consequence. The study did not involve any physical or psychological risks to participants, and all data was used for academic purposes only and stored securely in accordance with applicable regulations.

4. Results

Table 2 shows the results of the reflective measurement model analysis on self-efficacy, learning attitude, learning independence, metacognitive awareness, and metacognitive skills. Based on the outer loadings, several indicators do not meet the criteria (> 0.7) and must be removed (Out). Overall, the construct reliability for each variable shows good results, with Cronbach's alpha values ranging from 0.787 to 0.877 and Composite Reliability greater than 0.7, indicating adequate internal consistency. The Average Variance Extracted value for each variable is above the threshold of 0.5, indicating that convergent validity is achieved as each construct is able to explain more than 50% of the variance of its indicators.

Table 2
Results of the reflective measurement model analysis

Variables/ Construct	*Indicator/ Variable Items*	*Outer Loadings*	*Cronbach's alpha*	*Rho_A*	*Composite Reliability (CR)*	*AVE*
Self Efficacy	SE1	Out	0.819	0.825	0.873	0.580
	SE2	Out				
	SE3	0.726				
	SE4	0.800				
	SE5	0.770				
	SE6	0.761				
	SE7	0.748				
Learning Attitude	LA1	0.743	0.877	0.878	0.905	0.575
	LA2	0.748				
	LA3	0.806				
	LA4	0.705				
	LA5	0.745				
	LA6	0.794				
	LA7	0.764				
Learning Independence	LI1	0.807	0.787	0.791	0.862	0.610
	LI2	Out				
	LI3	Out				
	LI4	0.811				
	LI5	0.759				
	LI6	Out				
	LI7	0.745				
Metacognitive Awareness	MA1	Out	0.851	0.852	0.894	0.627
	MA2	0.800				
	MA3	0.834				
	MA4	0.735				
	MA5	Out				
	MA6	0.798				
	MA7	0.790				
Metacognitive Skills	MS1	0.767	0.875	0.877	0.903	0.571
	MS2	0.705				
	MS3	0.759				
	MS4	0.725				
	MS5	0.776				
	MS6	0.746				
	MS7	0.808				

Table 3 presents the results of the correlation analysis between variables using the Fornell-Larcker criterion to test discriminant validity. Based on the table, the diagonal values represent the

square root of AVE for each construct and must be greater than the correlation between that construct and other constructs. These results indicate that the square root AVE values for all variables self-efficacy (0.761), learning attitude (0.759), learning independence (0.781), metacognitive awareness (0.792), and metacognitive skills (0.756)—are higher than the correlation values between constructs in the corresponding rows and columns. This indicates that each variable has adequate discriminant validity, where each construct is more capable of explaining the variance of its own indicators compared to the shared variance with other constructs.

Table 3
Correlation between variables and AVE using the Fornell-Larcker Criterion

Variables/ Construct	*SE*	*LA*	*LI*	*MA*	*MS*
SE	0.761				
LA	0.734	0.759			
LI	0.630	0.600	0.781		
MA	0.564	0.660	0.643	0.792	
MS	0.567	0.625	0.663	0.772	0.756

Table 4 displays the results of the cross-loading analysis to evaluate discriminant validity at the indicator level. Based on the criteria for discriminant validity, the loading value of each indicator on the measured construct must be greater than the loading of that indicator on other constructs. The data in the table shows that each indicator has the highest loading value on its

Table 4
Indicator (variable item) cross-loading

Indicators/ Variable Items	*SE*	*LA*	*LI*	*MA*	*MS*
SE3	0.726	0.450	0.474	0.364	0.359
SE4	0.800	0.548	0.576	0.502	0.494
SE5	0.770	0.558	0.437	0.404	0.402
SE6	0.761	0.596	0.432	0.432	0.427
SE7	0.748	0.628	0.469	0.427	0.459
LA1	0.617	0.743	0.403	0.500	0.463
LA2	0.505	0.748	0.455	0.452	0.408
LA3	0.540	0.806	0.478	0.477	0.497
LA4	0.550	0.705	0.433	0.473	0.457
LA5	0.482	0.745	0.489	0.517	0.544
LA6	0.589	0.794	0.493	0.562	0.493
LA7	0.612	0.764	0.429	0.513	0.439
LI1	0.451	0.413	0.807	0.461	0.507
LI4	0.562	0.584	0.811	0.575	0.557
LI5	0.435	0.412	0.759	0.421	0.493
LI7	0.506	0.447	0.745	0.533	0.510
MA2	0.471	0.556	0.516	0.800	0.598
MA3	0.494	0.556	0.480	0.834	0.611
MA4	0.355	0.489	0.463	0.735	0.593
MA6	0.487	0.537	0.534	0.798	0.616
MA7	0.422	0.474	0.550	0.790	0.637
MS1	0.496	0.561	0.510	0.671	0.767
MS2	0.472	0.476	0.530	0.572	0.705
MS3	0.394	0.468	0.525	0.511	0.759
MS4	0.334	0.447	0.408	0.508	0.725
MS5	0.393	0.395	0.477	0.589	0.776
MS6	0.425	0.434	0.484	0.593	0.746
MS7	0.464	0.506	0.562	0.615	0.808

respective construct compared to the loading values on other constructs. On the indicator SE3, it has the highest loading value on the self-efficacy variable (0.726), while the loading values on other constructs are lower. Additionally, for other indicators of each construct, such as LA3 on learning attitude (0.806), LI4 on learning independence (0.811), MA3 on metacognitive awareness (0.834), and MS7 on metacognitive skills (0.808). These findings support discriminant validity at the indicator level, indicating that each indicator consistently measures the expected construct without significant overlap with other constructs.

Table 5 presents the path analysis results showing the direct and indirect effects between variables in the research model. In the direct effect, the path from self-efficacy [SE] to metacognitive awareness [MA] (H1) has a coefficient of 0.016 with a *p*-value of .796, indicating that this relationship is not statistically significant. Similarly, the path from self-efficacy [SE] to metacognitive skills [MS] (H2) and from learning attitude [LA] to MS (H4) also shows no significance (*p*-value .420) and (*p*-value .140). On the contrary, the path from learning attitude [LA] to metacognitive awareness [MA] (H3) and from learning independence (LI) to MA (H5) shows a statistically significant relationship, with coefficients of 0.419 and 0.381 respectively (*p*-value <.001). The path from MA to MS (H7) has the largest influence with a coefficient of 0.528 and a significant p-value (*p*-value <.001), indicating the important role of metacognitive awareness in influencing metacognitive skills.

In the indirect effect, the path from SE to MS through MA (H8) has a coefficient value of 0.009 with a *p*-value of .798, indicating that the mediation effect is not significant. On the other hand, the mediation effect of the LA to MS path through MA (H9) and LI to MS through MA (H10) is statistically significant with coefficient values of 0.222 and 0.201 respectively (*p*-value <.001). These results affirm that metacognitive awareness plays an important role as a mediator in the relationship between learning attitude and learning independence with metacognitive skills. Overall, this data shows that learning attitude and learning independence have a significant direct influence on MA and MS, as well as a mediating effect through MA, while self-efficacy does not show a significant contribution to the metacognitive variables.

Figure 2 illustrates the relationships between latent variables in the research model. The path coefficients indicate the influence between latent variables, where learning attitude (0.419) and learning independence (0.381) have a significant impact on metacognitive awareness, while metacognitive awareness has the largest influence on metacognitive skills with a coefficient of 0.528. On the other hand, the influence of self-efficacy on metacognitive awareness (0.016) and metacognitive skills (0.049) is not significant, indicating that self-efficacy has a weaker role in this model compared to other variables.

The coefficient of determination (R^2) is also evident in this model, with a value of .531 for metacognitive awareness and .653 for metacognitive skills. This shows that the variables of self-efficacy, learning attitude, and learning independence are able to explain 53.1% of the variability in metacognitive awareness. Next, the variable metacognitive awareness, along with other variables, explains 65.3% of the variability in metacognitive skills. This relatively high R^2 value indicates that the model has good predictive power, especially in explaining the development of metacognitive skills. This emphasizes the importance of learning attitudes, learning independence, and metacognitive awareness in supporting the development of students' metacognitive skills.

Table 6 presents the results of the multigroup analysis (PLS-MGA) based on gender to test the differences in path coefficients between groups. Based on the displayed results, all paths have *p*-values above .05, indicating that there are no significant differences in the influence between latent variables based on gender. For example, the path from self-efficacy to metacognitive awareness (SE → MA) has a *p*-value of .976, while the path from learning attitude to metacognitive awareness (LA → MA) has a *p*-value of .720, both of which are not significant. The path coefficient-diff values also show very small differences for all paths, such as a difference of 0.004 for SE → MA and

Table 5
Path Analysis

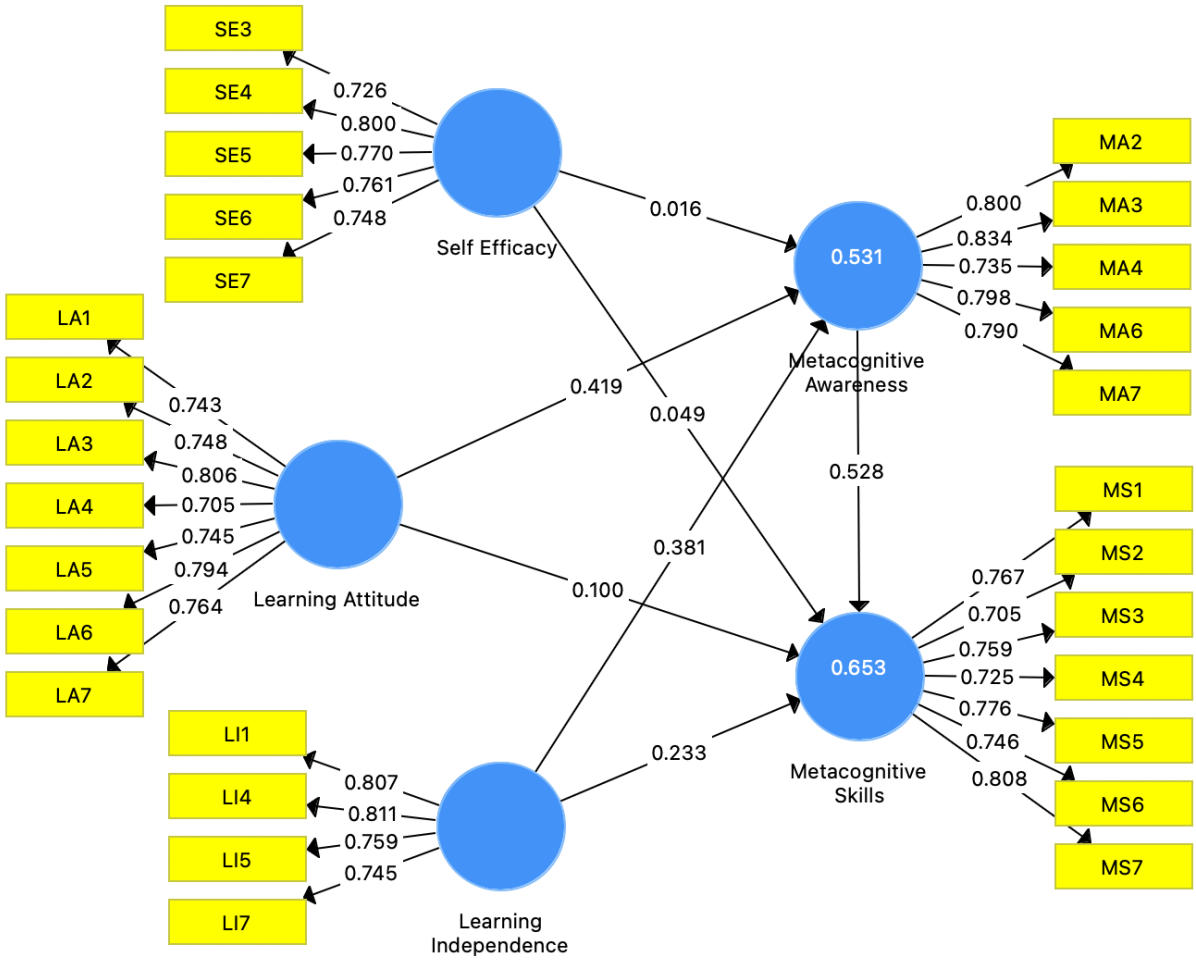
Hypothesis	*Path*	*Original Sample (O)*	*Sample Mean (M)*	*Standard Deviation (STDEV)*	*T-Statistics*	*p*
Direct Effects						
H1	SE → MA	0.016	0.020	0.063	0.258	.796
H2	SE → MS	0.049	0.055	0.061	0.806	.420
H3	LA → MA	0.419	0.418	0.066	6.349	.000
H4	LA → MS	0.100	0.098	0.068	1.476	.140
H5	LI → MA	0.381	0.381	0.051	7.529	<.001
H6	LI → MS	0.233	0.230	0.052	4.476	<.001
H7	MA → MS	0.528	0.528	0.055	9.675	<.001
Indirect Effects						
H8	SE → MA → MS	0.009	0.011	0.034	0.256	.798
H9	LA → MA→MS	0.222	0.220	0.040	5.597	<.001
H10	LI → MA → MS	0.201	0.201	0.035	5.779	<.001

Table 6
Path Coefficients between gender (PLS-MGA) Female and Male

Path	*Path Coefficients-diff*	*t*	*p*
SE → MA	0.004	0.364	.976
SE → MS	−0.081	0.465	.493
LA → MA	−0.047	0.171	.720
LA → MS	0.064	0.131	.632
LI → MA	0.017	0.454	.861
LI → MS	−0.014	0.034	.887
MA → MS	−0.049	0.673	.650

−0.049 for MA → MS. These results indicate that gender does not moderate the relationship between latent variables in the research model, so the influence of independent variables on metacognitive awareness and skills is consistent across both gender groups.

Figure 2
SEM Analysis Results



5. Discussion

The research results show that learning attitude and learning independence have a significant direct influence on metacognitive awareness. Additionally, metacognitive awareness was also found to have the largest direct influence on metacognitive skills. Meanwhile, self-efficacy does not have a significant direct influence on either metacognitive awareness or metacognitive skills. In the mediation effect, learning attitude and learning independence significantly influence metacognitive skills through metacognitive awareness. These results indicate that learning attitudes and learning independence are the main predictors in the development of students' metacognitive awareness and skills.

A positive learning attitude, such as enthusiasm, discipline, and responsibility towards learning, encourages students to actively engage in managing and monitoring their learning process, which is a core component of metacognitive awareness (Jahangard et al., 2016). This attitude also encourages students to adopt effective and adaptive learning strategies, thereby enhancing their metacognitive skills. Meanwhile, learning independence reflects students' ability to design, organize, and evaluate their learning activities without relying on external guidance. This ability allows students to develop a deeper awareness of their learning process, while also strengthening their skills in overcoming academic challenges through the adjustment of

appropriate learning strategies (Wang et al., 2018). The combination of a positive learning attitude and learning independence creates an environment conducive to the development of students' metacognitive abilities, making both important determinants in improving the quality of learning and academic outcomes.

The result of this research align with previous research which highlight the significance of learning attitude and learning independence in supporting students' metacognitive processes (Hindun et al., 2020; Ramadhanti & Yanda, 2021). Previous studies also highlight that students with a positive learning attitude are generally better at managing and monitoring their learning process (Santyasa et al., 2022; Tshering, 2024). This attitude also motivates students to use effective and adaptive learning strategies, Therefore, it enhance their metacognitive skills (Kehing, 2024; Ramzan et al., 2023). Additionally, learning autonomy, as assisted by self-determination theory Qosim, (2023), play a crucial role in fostering metacognitive awareness. This ability also helps students gain a deeper awareness of their learning processes, while simultaneously enhancing their skills in addressing academic challenges by adapting suitable learning strategies (Sánchez & Singh, 2022). On the other hand, these findings contrast with several researches that directly associate self-efficacy with metacognitive awareness and skills. The study by Usher and Pajares (2020) reveals a strong connection between self-efficacy and the ability to self-regulate. In this research, the limited impact self-efficacy could be attributed to contextual factors, such as differences in learning approaches or the demographic profile of students (Çelik & ARSLAN, 2022; Mazzola et al., 2023).

The insignificance of the influence of self-efficacy on students' metacognitive awareness and skills can be explained by its contextual and indirect role in supporting the metacognitive process. Self-efficacy focuses on students' belief in their ability to complete tasks, which tends to influence initial motivation and engagement in learning more than the reflection or evaluation processes underlying metacognitive awareness and skills (Duratun, 2023). In structured hybrid learning, students have limited space to develop confidence in independently managing their learning, so self-efficacy does not directly contribute to the enhancement of metacognitive abilities (Downing et al., 2011; Gavassa et al., 2019). In addition, the presence of mediating or moderating factors, such as learning experiences, environmental support, or intrinsic motivation, can reduce the direct effect of self-efficacy on metacognitive variables (Yelgeç & Dağyar, 2022). Therefore, further research is needed to explore the dynamics of the relationship between self-efficacy and students' metacognitive processes.

These findings emphasize the importance of designing educational interventions to enhance students' metacognitive awareness and skills. Teachers and education policymakers can integrate strategies that support self-efficacy, positive learning attitudes, and learning independence into the curriculum, such as encouraging project-based learning or providing greater autonomy to students in designing their learning strategies. In addition, these results highlight the importance of metacognitive awareness as the main mediator connecting these factors with metacognitive skills. Therefore, specialized learning that focuses on enhancing metacognitive awareness can have a significant impact on students' overall learning skills.

6. Conclusion

Learning independence has a significant direct influence on metacognitive awareness and metacognitive skills, but learning attitude can only affect the formation of metacognitive awareness. Metacognitive awareness can play an important role as a mediator that connects the variables of learning attitude and learning independence to metacognitive skills. Conversely, self-efficacy does not show a significant influence on the metacognitive variables, which is due to its more indirect role or being moderated by other factors such as intrinsic motivation and environmental support. The findings of this study also indicate that there are no significant differences in the influence among latent variables based on gender. These findings emphasize the importance of a positive learning attitude and learning independence in fostering the development

of students' awareness and metacognitive skills. Practically, the results of this research provide implications for educators and policymakers to design interventions that support the development of these two factors through an autonomy-based and reflective learning approach. With the right strategies, students can more effectively manage their learning processes and enhance higher-order thinking skills that support academic success and lifelong learning.

7. Recommendations

It is recommended that the educational process emphasizes more on developing quality learning attitudes and students' learning independence. Learning strategies based on self-reflection and self-regulation can be used to increase metacognitive awareness, which will ultimately have an impact on improving metacognitive skills. In addition, schools and educators need to provide mastery experiences, students are given tasks with gradually increasing levels of difficulty. By feeling the achievement at each stage, students will be more confident in facing more complex challenges. Schools are also required to carry out group-based learning which can be a means to build self-confidence so that it has an impact on students' metacognitive awareness and skills.

8. Limitations

The research design is cross-sectional which has the potential to identify causal relationships between variables, so longitudinal research is needed to understand the dynamics of the development of self-efficacy, learning attitudes, and learning independence in shaping students' awareness and metacognitive skills. The research sample is also limited to Muhammadiyah High School students in Surabaya which can reduce the generalization of findings to a wider scale. .

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Appendix 1. Statements for Each Indicator in the Research Instrument

Indicator/Variable Items	*Survey Item Statements*
SE1	I feel confident in completing hybrid learning tasks with satisfactory results.
SE2	I am able to understand the material presented, both online and in face-to-face settings.
SE3	I am confident that I can participate in online learning without relying entirely on others' assistance.
SE4	I can manage my time well between online and face-to-face learning.
SE5	I feel capable of facing technological challenges during online learning.
SE6	I am confident in actively participating, both in online and face-to-face discussions.
SE7	I am confident that I can achieve my learning goals in the hybrid learning model.
LA1	I feel enthusiastic about participating in hybrid learning.
LA2	I strive to complete the tasks assigned, both online and in face-to-face settings.
LA3	I appreciate the importance of discipline in following the hybrid learning schedule.
LA4	I feel comfortable interacting with teachers and friends, both online and face-to-face.
LA5	I strive to find solutions when facing challenges in hybrid learning..
LA6	I pay attention to the material presented in both online and face-to-face learning.
LA7	I consider hybrid learning beneficial for the development of my learning abilities..
LI1	I can manage my study time without anyone else's help.
LI2	I often look for additional learning resources (books, articles, videos) to deepen my understanding of the material..
LI3	I can complete my study tasks without always being given instructions or directions.
LI4	I am able to manage my own study schedule to complete hybrid learning tasks.
LI5	I can prioritize my studies even though there are many distractions from the surrounding environment.
LI6	I continue to study even though there is no direct guidance from the teacher.
LI7	I am able to overcome difficulties in learning without relying too much on others.
MA1	I realized the most effective way for me to learn in hybrid learning.
MA2	I am able to plan a study strategy before starting hybrid learning.
MA3	I often evaluate my understanding after studying, whether online or in person.
MA4	I can identify my mistakes in understanding the material and strive to correct them.
MA5	I realize when I need to ask for help if I encounter difficulties in my studies.
MA6	I monitor my learning progress during the hybrid learning process.
MA7	I am able to adjust my learning strategy if the method I previously used is not effective.
MS1	I am able to plan the steps I need to take before starting hybrid learning.
MS2	I can identify the material or topics that are difficult for me during hybrid learning.
MS3	I am able to control the way I learn to ensure I stay focused on my learning goals.
MS4	I often reflect on how I complete tasks to find better methods.
MS5	I am able to make the right decisions about the most effective learning strategies for me.
MS6	I can monitor and evaluate my learning progress during the learning process.
MS7	I am able to adjust my learning strategies to the conditions and challenges I face.